

AMENDMENT UNDER 37 C.F.R. § 1.111
U.S. Appln. No. 08/977,052

REMARKS

Claims 22-44 are all the claims pending in the application. Applicants thank the Examiner for indicating that claims 24-26, 28-32 and 40-43 are allowed. Applicants added claim 44 to further define the invention as discussed in detail below.

Claims 27 and 33-39 are rejected under 35 U.S.C. § 112, second paragraph, for minor informalities. Applicants amend the claims to remove any ambiguities.

Claims 22 and 23 are rejected under 35 U.S.C. § 102(b) as being anticipated by Dasgupta et al. (5,437,692).

Since no prior art rejections have been applied to claims 27 and 33-39, these claims are presumably allowable once the §112 rejection is overcome.

Analysis

Claim 22 is directed to a process for producing an organic electrolyte electric cell having a unitary structure and including at least one pair of electrodes. Claim 22 includes:

“a first electrode comprising the superposition of a first layer containing an electrochemically active material and a porous second layer of a polymeric material having a free face;”

This first electrode is different from the electrodes disclosed in Dasgupta. This first electrode of the present invention is constituted by a first layer containing the active material, which acts as an electrochemically active layer (page 4, lines 8-10), and a second layer made of a polymer material, which acts as a separator (page 4, lines 11-15). The second layer is porous.

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Dasgupta describes (col. 2, lines 35-40) an electrode having a first layer containing carbon particles carried by a second layer which is a polymer laminate. The first layer is a continuous layer of fine carbon particles agglomerated with a lithium compound containing organic binder such as ethylene carbonate, propylene carbonate or mixtures thereof, in which a lithium compound (LiPF_6 , LiCF_3SO_3 , ...) has been dissolved (col. 4, lines 24-27 to be compared with col. 8, lines 9-23).

In summary, Dasgupta does not describe the claimed electrode for the following reasons:

- 1) The polymer laminate of Dasgupta includes carbon particles, and it is conductive. It acts as a current collector, not as a separator;
- 2) Dasgupta does not teach a porous layer;
- 3) The organic binder is constituted by a lithium salt, as LiPF_6 , dissolved in an organic solvent as a mixture EC/PC. This type of solution is usually called a liquid electrolyte (see this application page 10, lines 28-31).

The process of the claimed invention also includes:

"said first and second electrodes are assembled by adhesive bonding, . . . by coating onto said free face of said porous layer of one of said two electrodes and then bringing said free face coated with a film of adhesive into contact with said free face of said porous layer of said other electrode to form an electrochemical couple."

Moreover, Applicants amend claim 1 to include a step of drying and impregnating the electrochemical couple with a liquid electrolyte including a lithium salt (page 10, lines 26-31).

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Drying causes evaporation of the adhesive solvent and a porous adhesive film is obtained (page 7, lines 30-32), so the electrolyte can be introduced in the film porosity.

First, the main characteristic of this process is that the components to be assembled do not contain the electrolyte, that is to say lithium ions. Applicants obtain a dry electrochemical couple. Once the electrochemical couple has been assembled, it is impregnated by a liquid electrolyte, for example LiPF₆ salt dissolved in a mixture of carbonates propylene carbonate/ethylene carbonate/dimethyl carbonate (page 10, lines 26-31). The adhesive is only composed of polymer(s) dissolved in a solvent and does not contain lithium ions.

In Dasgupta's process, each of the constituents of the assembly contains the electrolyte before gluing. The negative electrode is made of carbon particles agglomerated with a lithium compound containing organic binder (col. 2, lines 34-38) and the positive electrode is made of oxide particles agglomerated with a lithium compound containing organic binder (col. 2, lines 64-68). The commercially available organic binder may be ethylene carbonate, propylene carbonate or mixture thereof, in which a lithium compound has been dissolved (col. 4, lines 22-27). The commonly used lithium compounds include lithium triflate LiCF₃SO₃, lithium perchlorate LiClO₄, lithium borofluoride LiBF₆, lithium phosphofluoride LiBF₆, lithium arsenofluoride LiAsF₆ and others (col. 4, lines 27-31). In other words, a usual composition of electrolyte is a well-known lithium salt dissolved in a mixture of carbonates as a solvent. The microporous separator has been impregnated with a lithium compound containing organic liquid (col. 3, lines 17-25). The lithium ion containing fluid adhesive mixture is obtained by dissolving a lithium compound in a fluid adhesive mixture.

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According to Dasgupta, their method has three advantageous features (col. 12, liens 27-50):

- 1) it utilizes a lithium compound containing organic binder;
- 2) in one embodiment, it utilizes a microporous polymer laminate separator impregnated with an organic liquid containing a lithium compound; and
- 3) it provides a lithium ion containing adhesive coating.

None of these features is mentioned in the instant application.

Second, the assembling step is done by gluing. Classically it consists of spreading an adhesive film onto one face of one piece to be assembled and putting the other piece on the adhesive film. Only one adhesive layer is put between the two electrodes.

Dasgupta describes a process involving the spreading of at least two layers of adhesive. In one embodiment illustrated by Fig. 1b, at least a portion of each of the faces of the separator is coated with a fluid adhesive mixture (col. 8, lines 34-45). Then the two electrodes are applied respectively onto the two adhesive films.

In the other embodiment, two electrode-electrolyte subassembly are manufactured, each of them including an adhesive layer (col. 8, line 63 to col. 9, line 3 and col. 2, lines 34-63). Then a third adhesive layer is put between the two subassemblies.

Instead of being spread on the separator face, each adhesive film may be spread on the corresponding face of each electrode (col. 9, lines 9-16).

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In view of the foregoing, Applicants submit that claim 22 is patentable.

The remaining rejection is directed to claim 23. This claim is patentable for at least the same reasons as claim 22, by virtue of its dependency therefrom.

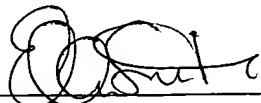
Finally, Applicants amend claim 28 and add 44 in view of the amendments to claim 22, discussed in detail above. Claims 29 and 44 are patentable due to their dependency from claims 24 and 26, respectively.

Conclusion

In view of the above, reconsideration and allowance of this application are now believed to be in order, and such actions are hereby solicited. If any points remain in issue which the Examiner feels may be best resolved through a personal or telephone interview, the Examiner is kindly requested to contact the undersigned at the telephone number listed below.

Applicants hereby petition for any extension of time which may be required to maintain the pendency of this case, and any required fee, except for the Issue Fee, for such extension is to be charged to Deposit Account No. 19-4880.

Respectfully submitted,



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APPENDIX

VERSION WITH MARKINGS TO SHOW CHANGES MADE

IN THE CLAIMS:

The claims are amended as follows:

22. (Amended) A process for [producing] the production of an organic electrolyte electric cell having a unitary structure [and including] comprising at least one pair of electrodes[, the process including the following steps] comprising:

[forming] a first electrode [out] comprising the superposition of a first layer containing an electrochemically active material and a porous second layer of a polymeric material having a free face; and

[forming] a second electrode [out of] comprising a porous layer having at least one free face and containing an electrochemically active material; [and]

[assembling] wherein said [first and second] electrodes are assembled by [applying an] adhesive bonding, bonding being carried out by coating an adhesive onto said free face of said porous layer of one of said two electrodes and then bringing said free [faces] face coated with a film of adhesive into [in mating] contact with said free face of said porous layer of said other electrode [one another] to form an electrochemical couple, and wherein said electrochemical couple is dried and then impregnated with an electrolyte.

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27. (Twice Amended) The process claimed in claim 26 wherein said solvent is selected from [a] the group consisting essentially of water and N-methylpyrrolidone.

29. (Amended) The process of claim [22] 24, further comprising the step of [drawing said first and second electrodes after said assembling step] drying said electrochemical couple to convert said adhesive into a porous film.

33. (Amended) The process claimed in claim 24, wherein said polymer is selected from [a] the group consisting essentially of polyvinylidene fluoride (PVDF), polyvinyl chloride (PVC), polymethylmethacrylate, cellulose triacetate (CA), a polysulfone, a polyether, a polyolefin [such as polyethylene (PE)], polyethylene oxide (PEO), polypropylene (PP) and copolymers thereof.

34. (Amended) The process claimed in claim 24, wherein said polymer is an alloy of polyvinylidene fluoride (PVDF) with a polymer selected from [a] the group consisting essentially of polysulfone, polymethylmethacrylate, polyvinylpyrrolidone and copolymers of polyvinylidene fluoride and polytetrafluoroethylene (PTFE), polyvinylidene flouride and propylene hexafluoride and polyvinyl acetate (PVAC) and polyvinyl alcohol (PVA).

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35. (Amended) The process claimed in claim 24, wherein said polymer is an alloy constituted by a polymer selected from [a] the group consisting essentially of polyurethanes, an acrylonitrile-butadiene copolymer, a styrene-butadiene-styrene copolymer, a styrene-isoprene-styrene copolymer, polyesters, amide block polyethers and a polymer selected from the group consisting of polyvinylidene [fluroide] fluoride and its copolymers, polyacrylonitrile, polymethylmethacrylate, polyvinylformal, polybutylmethacrylate and polyvinylchloride.

38. (Amended) The process claimed in claim 36, wherein said non-solvent is selected from [a] the group consisting essentially of butanol, propanol and ethylene glycol.

39. (Amended) The process claimed in claim 26, wherein said polymer is selected from [a] the group consisting essentially of polytetrafluoroethylene, carboxymethylcellulose, hydroxypropylmethylcellulose, hydroxyethylcellulose, hydroxypropylcellulose, polyvinylidene fluoride and its copolymers, polyacrylonitrile, polyacrylic acid, polyacrylamide and mixtures thereof.

Claim 44 has been added.